

Appendix J.2.10 Landfill Leachate, Land Application

Missouri Clean Water Law and regulations

Introduction:

The requirements for design of land application facilities are outlined in state regulations under **10 CSR 20, Chapter 6, 7 and 8.**

[Chapter 6: Permitting requirements.](#)

[Chapter 7: Water quality standards](#)

[Chapter 8: Design guidelines.](#)

Other selected reference publications with technical information on this topic are listed in [Appendix A.](#)

Typical landfill leachate concentrations for selected pollutants compared to design guidelines for land application and Water Quality Standards are presented in [Appendix B.](#)

Typical landfill leachate exceeds the design guideline values for general land application. Therefore, an engineering report must be submitted to provide a detailed environmental assessment for each individual pollutant on a site-specific basis as outlined in 10 CSR 20-8.020(3)(D).

Additional information on typical leachate concentrations of other priority pollutants (40 CFR 122.21, Appendix D) must also be provided in the engineering report. Additional details on this process are addressed under the following topics.

Permitting Requirements:

Permitting requirements for land application facilities are outlined in **10 CSR 20-6.015**. Section (4) of this rule provides cross references to other applicable water quality standards and design rules.

Permit application forms A, C and D include the applicable testing requirements. This includes the priority pollutants as listed in **40 CFR 122.21, Appendix D, Tables II, III and IV.**

Monitoring and limitations in storm water runoff and ground water monitoring wells will normally be required to document that the design and operation of the land application facility complies with applicable water quality criteria. This may require a groundwater monitoring well system consisting of several upgradient and downgradient wells and storage basin(s) for collection of storm water runoff from the land application areas. Monitoring of wastewater prior to land application and testing of soils and crops may also be required.

Water Quality Standards:

The land application design must be capable of meeting water quality standards for surface water and groundwater in accordance with **10 CSR 20-7.031**. Section (4) and Tables A and B of this rule provide specific numeric criteria for pollutants that have limitations established. For pollutants not listed, the concentrations in waters of the state shall not exceed background levels in accordance with the antidegradation criteria in Section (2) of 10 CSR 20-7.031.

Design Regulations:

The requirements for the land application of any industrial wastewater including landfill leachates is outlined in design rules under **10 CSR 20-8.020** and **10 CSR 20-8.220**. These two rules require submittal of an engineering report with justification for proposed loading rates on a site-specific basis. Design of land application facilities should be based on expected wastewater (leachate) and storm water flows during the wettest 1-in-10 year return frequency (Section (15) of 10 CSR 20-8.020). A list of other selected reference publications are listed in [Appendix A](#).

Typical leachate characteristics should be based on maximum values or highest 90 percentile values for a mature landfill leachate. Initial leachate samples are not adequate for design purposes. Typical leachate concentrations for a few pollutants are listed in **Reference #1**.

However, we are not aware of any published information on the concentration in leachate for the other priority pollutants listed in 40 CFR 122.21, Appendix D. Information on those priority pollutants must be provided by the applicant as part of the engineering report.

Guidelines for a few pollutants are listed in Table 4-5 of the EPA municipal irrigation guidelines (**Reference #2**) which are incorporated by reference under 10 CSR 20-8.020(15)(F)8.

Additional pollutants of special concern are also listed in Table 4-16 of this publication. A comparison of typical leachate concentrations to the EPA guidelines is provided in [Appendix B](#).

Leachate concentrations for Boron, Chlorides and Sodium exceed the guideline concentrations for land application.

Land application may still be possible at a very reduced hydraulic loading rate, but this would require a detailed environmental assessment based on a mass balance loading for each of these pollutants. Land application does not provide effective treatment for these three pollutants.

Boron is toxic to most crops at these concentrations. In addition, Boron, Chlorides and Sodium will accumulate in soils causing potential plant toxicity, especially in slowly permeable soils and during dry periods. Excess sodium, depending on the sodium adsorption ratio (sodium, calcium and magnesium), may also cause surface sealing of the soil, thus reducing infiltration rates and increasing storm water runoff. If soils are more permeable, excessive amounts of these pollutants may leach into groundwater and may cause violations of water quality standards.

Nitrogen land application rates may also be a limiting factor. Nitrogen in typical leachates would limit land application rates to a range of 1.0 to 6.0 inches/acre/year depending on crops grown and pretreatment provided to the leachate prior to land application. Nitrogen rates are addressed in 10 CSR 20-6.015(15)(F)7 and **Reference #3**.

Loading limits and toxicity information must be addressed in the engineering report for the other priority pollutants not listed in the design guidelines. Suggested guidelines for these are addressed in the other references listed in [Appendix A](#). See **References #4 through #7**.

The **engineering report** must include an environmental impact analysis as outlined in 10 CSR 20-8.020((3)(D) as follows:

The engineering report shall contain a detailed waste description, laboratory analyses and documentation of the treatability and potential environmental pathways for each constituent that may be present in the waste and wastewater.

If toxicity and treatability information is not available for a particular pollutant, the pollutant concentrations in the wastewater to be land applied should meet one of the following:

- a. Concentration limits for land disposal of wastewater in 40 CFR 268.43;
- b. Table A and B concentrations from 10 CSR 20-7.031;
- c. Background levels in surface and groundwater at the site; or

d. Laboratory detection limits for each pollutant.

Appendix A

Reference List:

1. **Leachate Characteristics For Missouri Sanitary Landfills**, Lee D. Tharp, Masters Thesis, May 1993. Available from author at Midwest Environmental Consultants, 522 E. Capitol avenue, Jefferson City, MO 65101, (573) 636-9454.
2. **Land Treatment of Municipal wastewater**, U.S. Environmental Protection Agency, (EPA 625/1-81-013), October 1981.
3. **Soil Test Interpretations and Recommendations Handbook**, University of Missouri - Columbia, Department of Agronomy, Revised December 1992. Contact John Lory (573) 884-7815.
4. **Land Disposal Restrictions**, U.S. EPA Hazardous Waste Rules, 40 CFR 268.43
5. **Design of Land Treatment Systems for Industrial Wastes**, Michael Ray Overcash, North Carolina State, 1979.
6. **Proceedings of the Industrial Wastewater/Sludge Land Application Training Workshop**, University of Missouri Extension, May 1997. Contact Bob Broz at (573) 882-0085.
7. **Environmental Data on Organic Chemicals**, 3rd Edition, Karel Vershueren, 1996.
8. **Geography of Soil Geochemistry of Missouri Agricultural Soils**, Geological Survey of Missouri, USGS Professional Paper 954-H,I, 1984.
9. **NPDES Priority Pollutants**, U.S. EPA, 40 CFR 122.21, Appendix D.
10. **Ground Water Handbook**, U.S. EPA, Volume I (EPA/625/6-90-016a) September 1990 and Volume II (EPA/625/6-90/016b) July 1991.

Appendix B

Summary of Selected Key Pollutants (mg/L)

Pollutant	Landfill Leachate *		Design Guide **	(10 CSR 20-7.015) Water Quality Standards	
	Avg	Max		Surface	Groundwater
Arsenic	0.016	0.13	0.2	0.02	0.05

Barium	7.13	205	x	x	2
Beryllium	0.003	0.02	0.2	0.005	0.004
Boron	2.07	6.9	1.4	2	x
Cadmium	0.02	0.1	0.02	0.001	0.005
Chloride	1100	5031	106	230-860	250
Chromium	0.022	0.2	x	0.011	0.1
Copper	0.02	0.08	0.4	0.019	1.3
Flouride	1.19	6.47	1.8	x	x
Iron	31.7	248	10	0.3	0.3
Lead	0.04	0.7	10	0.009	0.015
Mercury	0.0013	0.032	x	0.002	0.002
Nickel	0.078	0.74	0.4	0.1	0.1
Selenium	0.0012	0.012	0.04	0.005	0.05
Silver	0.003	0.063	x	0.0035	0.05
Sodium	673	3610	69	x	x
Sulfate	60	471	x	x	x
Zinc	0.27	2.3	4	0.1	5
TDS	4881	10600	x	x	x

TSS	114	166	x	x	x
Nitrogen:					
TKN	154	457	***	x	x
Ammonia-N	135	457	***	x	x
Nitrate-N	7	81	***	x	x
Phosphorus-P	1.38	5.4	x	x	x
pH	6.9	9.6	6.5-8.5	x	x
BOD	154	505	x	x	x
COD	800	2400	x	x	x
Priority Pollutants	NA	NA	x	x	x

NA = Not Available

x = No data

* See Appendix A, **Reference #1**.

** See Appendix A, **Reference #2**, Tables 4-5 and 4-16. This EPA publication is incorporated by reference into the Chapter 8 rules at 10 CSR 20-8.020(15)(F).

***: Total Nitrogen land applied should not exceed plant available nitrogen (PAN) requirements for crops to be grown. Total N = 538 mg/L (457 mg/l TKN + 81 mg/L nitrate). Total N of 538 mg/L x 0.226 = 122 pounds N/acre inch. PAN = Total N x 0.6 availability factor.